

**Environmental Review Case Study for the Sequoya Fuels Corporation  
Uranium Conversion Site in Gore, Oklahoma**

By  
Harry Felsher  
U.S. Nuclear Regulatory Commission  
Rockville, Maryland 20852  
September 2014

Capstone Paper submitted in partial fulfillment of the  
requirements for the Certificate in NEPA  
Duke Environmental Leadership Program  
Nicholas School of the Environment at  
Duke University

2014

## EXECUTIVE SUMMARY

This environmental review case study reviews the historical information regarding the Sequoyah Fuels Corporation's (SFCs) uranium conversion site (U.S. Nuclear Regulatory Commission (NRC) Materials License No. SUB-1010, Docket No. 04008027) in Gore, Oklahoma as well as the activities undertaken by the NRC to meet The National Environmental Policy Act (NEPA) of 1969, as amended<sup>1</sup> and the NRC regulations implementing NEPA, found in Title 10, "Energy," of the Code of Federal Regulations (CFR), Part 51 (10 CFR Part 51)<sup>2</sup>.

This case study specifically addresses the following three questions:

- How did groundwater contamination affect the NEPA environmental impact statement (EIS) required issues?
- How did the NEPA process help or hinder the NRC?
- How did the NRC decisionmakers use or not use the information in the NRC Final EIS?

The SFC operated a uranium conversion facility at the site in Gore, Oklahoma; however, it stopped operating in 1993 following a release of nitrous oxide in November 1992. The SFC submitted Decommissioning Plans to the NRC for the site in 1998 and March 1999<sup>3</sup>, which requested to consolidate contaminated sludges and soils, demolish existing structures (with the exception of the administration building and the electrical substation), and construct an above-grade, on-site disposal cell for the permanent disposal of all contaminated materials. Issues were raised regarding restricted-release of the site and classification of waste as byproduct material, as defined in Section 11e.(2) of the Atomic Energy Act of 1954 (as amended), which led the SFC to submit to the NRC the following: (1) a Reclamation Plan in 2003 that was revised in December 2006<sup>4</sup>; (2) a groundwater monitoring plan in 2003 that was revised in February 2005<sup>5</sup> and approved by the NRC in August 2005; and (3) a groundwater corrective action plan in June 2003<sup>6</sup> that was revised in June 2010 and approved by the NRC in September 2010.

A major technical issue is significant groundwater contamination at the site. The SFC submitted an Environmental Report to the NRC in October 2006<sup>7</sup>. The NRC published the draft EIS for public comment in September 2007, held a public meeting in Gore, Oklahoma in October 2007,

and published the Final EIS in May 2008<sup>8</sup>. In 2013, the NRC conducted in-process inspections of the SFC decommissioning activities. It is expected that closure of the SFC site will occur in 2018.

## BACKGROUND

The Sequoyah Fuels Corporation (SFC) uranium conversion facility in Gore, Oklahoma is located in Sequoyah County about 150 miles east of Oklahoma City, Oklahoma; 40 miles west of Fort Smith, Arkansas; 25 miles southeast of Muskogee, Oklahoma; and 2.5 miles southeast of Gore, Oklahoma (see Figure 1 below).

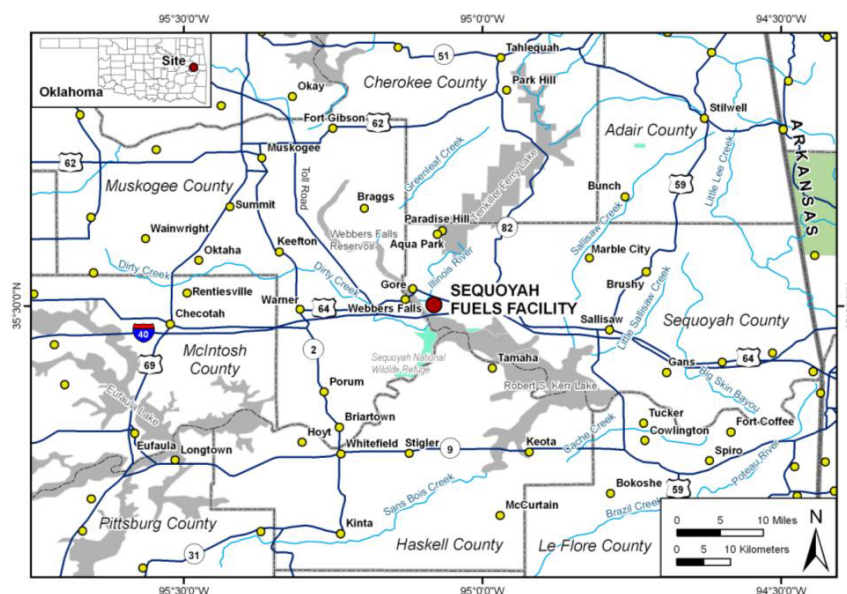


Figure 1 – SFC Location

Figure 2 below shows the Industrial Area of the site, which includes the disposal cell, institutional control boundary, and the agricultural lands. Most of the land outside of the institutional control boundary is used either for grazing cattle or producing forage.

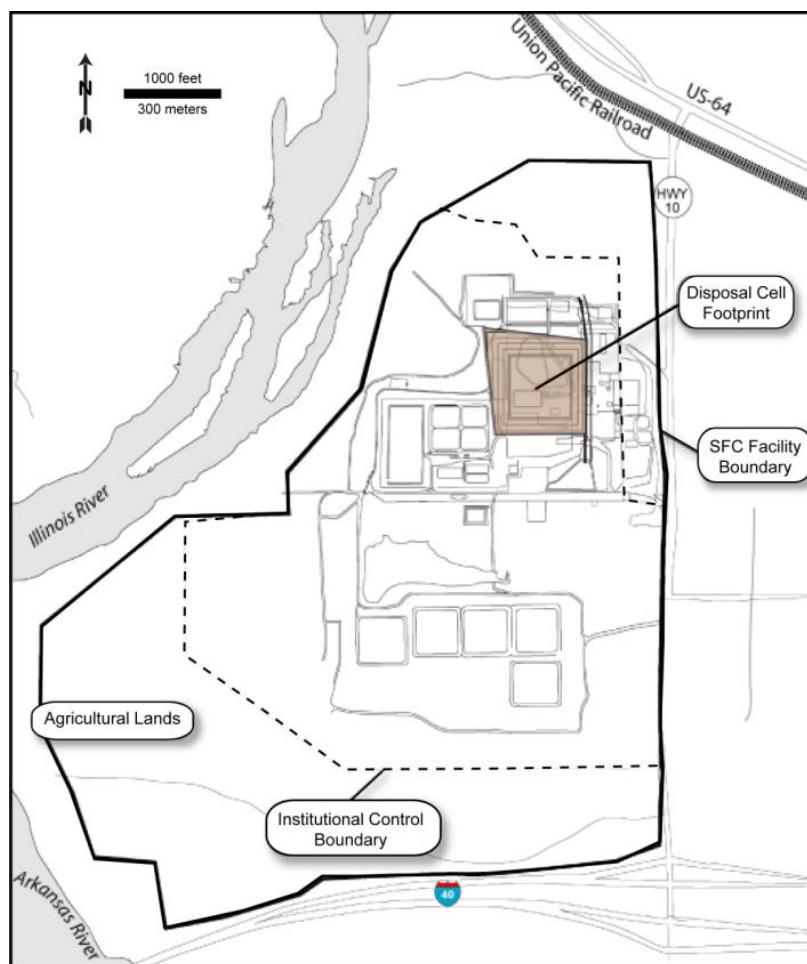


Figure 2 – SFC Industrial Area

In November 2009, SFC began construction of the 8.3-million-cubic-foot onsite disposal cell in which most of the residual waste material will be placed for permanent disposal (see Figure 3 below).

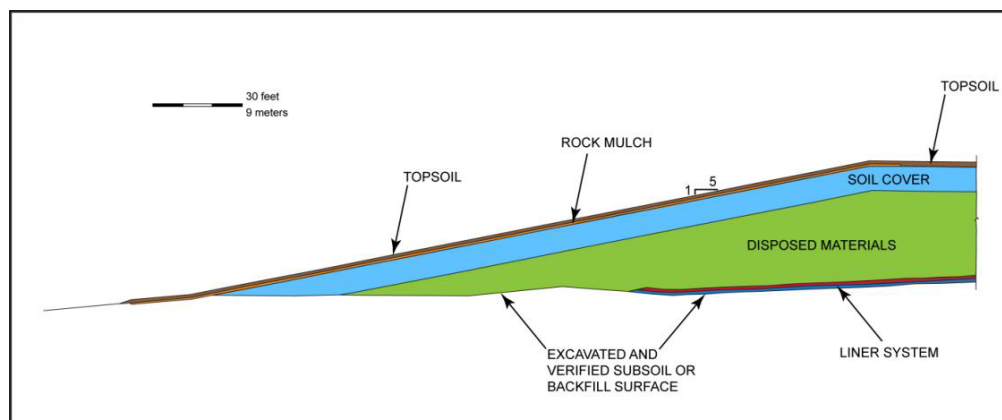


Figure 3 – Onsite SFC Disposal Cell

The NRC performed a review under The National Environmental Policy Act (NEPA) of 1969, as amended, for the SFC uranium conversion facility in Gore, Oklahoma. The NRC Final Environmental Impact Statement (EIS) evaluated the 2006 SFC proposed Reclamation Plan, (i.e., determination of potential environmental impacts of the site reclamation activities). From 1970 until 1993, the SFC operated a uranium conversion facility under the authority of the NRC Materials License SUB-1010, issued pursuant to Title 10, “Energy,” of the Code of Federal Regulations (CFR), Part 40 (Domestic Licensing of Source Material) (10 CFR Part 40). During that time, two major operations were conducted at the facility: (1) conversion of uranium oxide (yellowcake) to uranium hexafluoride ( $UF_6$ ); and (2) conversion of depleted uranium hexafluoride ( $DUF_6$ ) to depleted uranium tetrafluoride ( $DUF_4$ ). More details on those processes, including the resultant raffinate sludge, are in Section 2.1 of the NRC Final EIS. The SFC proposed Reclamation Plan focused on the Industrial Area [81-hectare (200-acre)] and Process Area [34-hectare (85-acre)] within the Industrial Area of the site.

Contaminated materials are present throughout the Process Area of the SFC site, including scrap materials/debris, soils, and groundwater; buried wastes; ponds containing sludges; surfaces of equipment; and some surfaces/interiors of process buildings. Uranium was detected at concentrations above 35 picocuries per gram (pCi/g) in soil below the Process Area to a maximum depth of about 9 meters (31 feet). The dewatered raffinate sludge from the conversion process (i.e., Section 11e.(2) material totaling approximately 6,995 cubic meters (9,150 cubic yards)) is stored on a concrete pad in the central portion of the site in covered “super sacks” containing a significant fraction of the radionuclides present on site (34% of the uranium (41.5 curies), 76% of the thorium-230 (156 curies), and 38% of the radium-226 (1.1 curies) as well as other metals). Low-level radioactive waste (LLW) (e.g., contaminated drums, equipment) was buried by the SFC in the 1970s and 1980s within the Process Area. There was some State of Oklahoma and NRC approved injection well work done 1982; but, due to public opposition, the injection well was abandoned and plugged in 1985. The history of the deep injection well at the site is included in Appendix G of the NRC Final EIS. Uranium and thorium contamination of the soils and subsoils was identified in the Process Area. The

groundwater is contaminated with uranium, thorium, and metals. Chemical contaminants on the site include fluoride, arsenic, lead, antimony, and other metals.

Outside the NEPA process, there were other issues being discussed through the justice system. A hearing was granted to the State of Oklahoma and the Cherokee Nation on issues related to the SFC proposed Reclamation Plan. Additionally, Oklahoma appealed the Commission's decision regarding classification of some wastes as Section 11e.(2) byproduct material to the U.S. Tenth Circuit Court of Appeals. Oklahoma also petitioned for a hearing on the SFC proposed plan to dewater raffinate sludges that were in settlement ponds. Negotiations between Oklahoma, the Cherokee Nation, and the SFC were successful in resolving the plans for dealing with the issues. As a result, the lawsuit was withdrawn and the hearings were terminated.

## **ACTIVITIES TO MEET NEPA AND 10 CFR PART 51**

The SFC submitted Decommissioning Plans for the site to the NRC in 1998 and 1999 and proposed utilizing an onsite, above-grade disposal cell for the permanent disposal of LLW and restricted-release of the site, in accordance with 10 CFR 20.1403 (License Termination Rule). However, that regulation requires the commitment of a responsible party to act as a custodian of the site and the SFC was unable to obtain such a commitment.

In January 2001, the SFC requested the NRC to determine that waste from the solvent extraction portion of the UF<sub>6</sub> conversion process could be classified as byproduct material, as defined in Section 11e.(2) of the Atomic Energy Act of 1954, as amended (AEA) (i.e., wastes from extraction or concentration of uranium or thorium from any ore processed for source material). A Section 11e.(2) byproduct material site must be remediated in accordance with Appendix A of 10 CFR Part 40. A site remediated in accordance with Appendix A that contains Section 11e.(2) byproduct material above specified concentrations must be transferred to a government custodian for perpetual custodial care. The custodian can be the State where the Section 11e.(2) site is located; but, if the State declines, then the U.S. Department of Energy (DOE) must become the custodian.

In the July 25, 2002, NRC Staff Requirements Memorandum for SECY-02-0095, the Commission concluded that the SFC front-end waste can be classified as Section 11e.(2) byproduct material and can be disposed of in accordance with the uranium mill tailings impoundment regulations in Appendix A of 10 CFR Part 40. The Commission based its decision on the pros and cons, including that the re-classification was legal, DOE had agreed to become the custodian, and the Cherokee Indian Nation preferred it if offsite disposal of all of the waste was not possible. On September 30, 2002, the SFC submitted a License Amendment to the NRC to allow possession of the Section 11e.(2) byproduct material. On December 11, 2002, the NRC approved the amendment with several License Conditions, including that the SFC submit a site Reclamation Plan to the NRC by March 15, 2003. The SFC submitted the proposed Reclamation Plan to the NRC by the deadline and submitted a revision to the NRC many times since then. NRC approved the SFC Reclamation Plan in April 2009, including using the Final EIS as a basis for approval.

In June 2003, the SFC submitted a groundwater monitoring plan (GWMP) and a groundwater corrective action plan (GWCAP) to the NRC. The SFC revised the GWMP in February 2005 and the NRC approved it in August 2005. After the NRC issued the Final EIS in May 2008, the SFC revised the GWCAP in June 2010 and the NRC approved it in September 2010.

The SFC submitted an Environmental Report (ER) to the NRC in October 2006. The NRC published the draft EIS for public comment in September 2007, held a public meeting in Gore, Oklahoma in October 2007, and published the Final EIS in May 2008. In 2013, the NRC conducted in-process inspections of the SFC decommissioning activities. It is expected that closure of the SFC site will occur in 2018. See Table I below for a summary of the SFC and the NRC actions with dates:

Table I – Summary of NRC Actions with Dates

<i><b>Action</b></i>	<i><b>Date</b></i>
SFC submitted the initial Reclamation Plan	January 2003 ( <i>revised many times</i> )
SFC submitted the initial GWMP	June 2003 ( <i>revised later</i> )
SFC submitted the initial GWCAP	June 2003 ( <i>revised later</i> )
SFC submitted the GWMP ( <i>used for Final EIS</i> )	February 2005

<i>Action</i>	<i>Date</i>
NRC approved the GWMP ( <i>used for Final EIS</i> )	August 2005
SFC submitted the ER	October 2006
SFC submitted the Reclamation Plan ( <i>used for Final EIS</i> )	December 2006
NRC Draft EIS - Federal Register Notice availability	September 17, 2007
NRC Draft EIS - Public Meeting held	October 16, 2007
NRC Draft EIS - Public Comment Period ended	November 5, 2007
NRC provided the Final EIS to the U.S. Environmental Protection Agency	April 2008
NRC issued the Final EIS	May 2008
NRC approved the Reclamation Plan	April 2009
SFC submitted the most recent GWCAP	June 2010
NRC approved the GWCAP	September 2010

### **Summary of the Recommendation in the NRC Final EIS**

For NEPA reviews, the NRC follows the 10 CFR Part 51 NRC NEPA regulation, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.” For this SFC NEPA review, the NRC used the August 2003 guidance document NUREG-1748<sup>9</sup> “Environmental Review Guidance for Licensing Actions Associated with NMSS Programs.” The NEPA requires issues or areas of the NRC SFC NEPA review were: (1) land use, (2) surface water resources, (3) groundwater resources, (4) public and occupational health, (5) transportation, (6) cultural resources, (7) visual and scenic resources, (8) geology and soils, (9) climate, meteorology, and air quality, (10) ecological resources, (11) socioeconomic conditions, (12) environmental justice, and (13) noise.

As a result, in accordance with 10 CFR 51.9(d):

- The NRC weighed the impacts of the SFC proposed action and compared the alternatives, including the No Action Alternative.
- The NRC recommended approval of the SFC proposed action.
- The NRC concluded that the applicable environmental monitoring program and the proposed mitigation measures would eliminate or substantially lessen any potential adverse environmental impacts associated with the SFC proposed action.



### THREE QUESTIONS

This environmental review case study specifically addresses the following three questions:

- How did groundwater contamination affect the NEPA EIS required issues?
- How did the NEPA process help or hinder the NRC?
- How did the NRC decisionmakers use or not use the information in the NRC Final EIS?

#### How did groundwater contamination affect the NEPA EIS required issues?

One of the NEPA EIS required issues/areas is called “groundwater resources.” Groundwater contamination was specifically addressed in the NRC Final EIS. There is significant groundwater contamination at the SFC site, which the GWMP and GWCAP are intended to address by cleaning up existing groundwater contamination that resulted from previous SFC operations. The goal of the cleanup is to reduce the concentrations of the identified hazardous constituents in the groundwater to the approved concentration limits for each constituent, which are protective of public health and safety and the environment.

From the NRC Final EIS:

During operations, SFC inadvertently released radioactive materials into the ground, contaminating the surrounding soil and groundwater. Elevated concentrations of uranium have been identified in the upper levels of groundwater in the vicinity of the main process building. There also are groundwater plumes from the storage ponds with uranium concentrations exceeding the drinking water standard contained in 40 CFR 141.66 (30 milligrams per liter [mg/L]).

The public is concerned that contaminated groundwater plumes could reach underlying aquifers and believes the groundwater should be cleaned up before such plumes reach local rivers or the Robert S. Kerr Reservoir. The public also is concerned that, even after the completion of surface reclamation, seepage from the on-site disposal cell could still be directed downward to the groundwater and ultimately reach surface water resources. Under [the SFC] proposed action, approximately 112 hectares (276 acres) would be made available to the public for unrestricted use. An alternative to [the SFC] proposed action would make the entire site (243 hectares [600 acres]) available for unrestricted use.

How did the NEPA process help or hinder the NRC?

The NEPA process helped NRC by focusing the environmental review on what the important areas of concern were, what the impacts associated with those areas of concern were, and what the magnitude of those impacts were.

The SFC proposed action was to conduct reclamation activities in accordance with 10 CFR Part 40, Appendix A. The NRC evaluated the implementation of the SFC proposed action for reclamation of the site (and the reasonable alternatives) as well as the No Action Alternative. The NRC determined that there would be unavoidable adverse environmental impacts. Those unavoidable adverse environmental impacts associated with each alternative are generally SMALL, although they could be as high as MODERATE in the area of land use and LARGE for the No Action Alternative. For further information, see Chapter 8 (Summary of Environmental Consequences) of the NRC Final EIS (see summary in Table II below):

Table II – Summary of Unavoidable Adverse Impacts

<b>1 – Proposal:</b> On-site disposal of contaminated materials	Impact of land use:  <b>MODERATE</b>	Impact of construction-related resources:  <b>SMALL</b>	Impact of non-radiological waste streams: <b>SMALL</b>
<b>2 – 1<sup>st</sup> Alternative:</b> Off-site disposal of <u>all</u> contaminated materials		Impact of buildings and materials disposal:  <b>SMALL</b>	Impact on topsoil:  <b>SMALL</b>
<b>3 – 2<sup>nd</sup> Alternative:</b> Some off-site disposal of contaminated materials	Impact of land use:  <b>MODERATE</b>	Impact of construction-related resources:  <b>SMALL</b>	
<b>4 – 3<sup>rd</sup> Alternative:</b> No action	Impact of land use:  <b>LARGE</b>		

How did the NRC decisionmakers use or not use the information in the NRC Final EIS?

The NRC decisionmakers used the information in the NRC Final EIS information as part of making a licensing decision of whether or not to approve the SFC Reclamation Plan. Based on details and the NRC recommendation in the NRC Final EIS, the NRC decisionmakers made a

licensing decision, including approving the SFC proposed Reclamation Plan, in Amendment #33 to NRC Materials License SUB-1010<sup>10</sup>.

From the NRC letter that approved the SFC Reclamation Plan:

The NRC previously issued a Final [EIS that] discusses the purpose and need for [the SFC] proposed surface reclamation activities and groundwater corrective actions, and reasonable alternatives to the proposed action, including the no-action alternative. The Final EIS also discusses the environment potentially affected by [the SFC] proposal, presents and compares the potential environmental impacts resulting from the proposed action and its alternatives, and identifies mitigation measures that could eliminate or lessen the potential environmental impacts. In the Final EIS, [the NRC] concluded that the proposed action is protective of human health, safety, and the environment with small effects on the physical environment and human communities with the exception of land use, for which the impact would be moderate.

## **CONCLUSION**

Following NEPA and 10 CFR Part 51, the NRC determined the environmental impacts of the proposed SFC Reclamation Plan (as well as alternatives) in the Final NRC EIS and the NRC decisionmakers made a licensing decision by approving the SFC Reclamation Plan. The SFC decommissioning process is ongoing, the NRC will continue to inspect the decommissioning of the SFC site, and the NRC expects that decommissioning of the SFC site will be completed in 2018.

## DEFINITIONS

*Derived Concentration Guideline Levels (DCGLs):* Derived, radionuclide-specific, activity concentrations that correspond to the release criterion. DCGLs are derived from activity-to-dose relationships as determined through modeling of radiation exposure pathway scenarios.

*Determination of the Significance of Potential Environmental Impacts:* Standard of significance established by the NRC for assessing environmental impacts. With standards based on the White House Council on Environmental Quality regulations, each impact should be assigned one of the following three significance levels:

SMALL: The environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

MODERATE: The environmental effects are sufficient to alter noticeably but not to destabilize important attributes of the resource.

LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

*Dewatered raffinate sludge:* Sludge from the bottom of SFC ponds that has gone through a dewatering process, such that the sludge volume has been reduced to approximately one-third of the original volume. The sludge is currently stored on-site in covered, 1-cubicyard-capacity packages known as “super sacks.”

*Raffinate:* A liquid acid solution resulting from the solvent extraction process and containing impurities such as nitric acid, metallic salts, and small quantities of uranium, thorium-230, and radium-226.

*Source Material:* (1) uranium, thorium, or any other material which is determined by the NRC pursuant to the provisions of section 61 of the Atomic Energy Act of 1954, as amended, to be source material; or (2) ores containing one or more of the foregoing materials, in such concentration as the NRC may by regulation determine from time to time.

*Uranium and Depleted Uranium:* Naturally occurring uranium consists of uranium-238 (99.27%), uranium-235 (0.72%), and uranium-234 (0.01%), which are called isotopes of uranium. Depleted uranium results from processes that separate the isotopes of uranium, such that the remaining residue contains a lower percentage of U-235 than shown above.

*Yellowcake:* The powder-like substance product from a uranium mill (chemical plant) that extracts uranium from mined ore. The substance is a mixture of uranium oxides. It is called yellowcake due to its color.

**REFERENCES**

1. *The National Environmental Policy Act of 1969, as amended* (Public Law 91-190, 42 United States Code 4321-4347, January 1, 1970, as amended by Public Law 94-52, July 3, 1975; Public Law 94-83, August 9, 1975; and Public Law 97-258, Section 4(b), September 13, 1982)
2. 10 CFR Part 51, *Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions*
3. Sequoya Fuels Corporation (SFC), *Decommissioning Plan*, March 26, 1999
4. SFC, *Reclamation Plan*, Rev. 2, December 2006
5. SFC, *Groundwater Monitoring Plan*, February 25, 2005
6. SFC, (Groundwater) Corrective Action Plan, June 2003
7. SFC, *Environmental Report [for the] Reclamation Plan*, October 13, 2006
8. U.S. Nuclear Regulatory Commission (NRC), *Environmental Impact Statement for the Reclamation of the Sequoyah Fuels Corporation Site in Gore, Oklahoma – Final Report*, NUREG-1888, May 2008
9. NRC, *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs*, NUREG-1748, August 2003
10. NRC, *Amendment 33 – Sequoyia Fuels Corporation – Materials License No. SUB-1010 – Approval of Reclamation Plan for Sequoyah Fuels Corporation Facility*, April 20, 2009